POLLUTION CONTROL COSTS

for

CANADA

in

1980

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PREFACE

The figures in this paper represent the third attempt that this branch has made at putting an estimate on pollution abatement costs for 1980.

The initial attempt, in 1971, arrived at an annual figure of $2 billion. However, this figure did not include any solid waste disposal costs and the automobile emission standards had not yet been firmly established. Also the other estimates were based on what can now be considered sketchy information. The second set of estimates was released earlier this year. This edition had a total pollution abatement cost figure of almost $6 billion annually. This was a more rigorous study than the previous one, but again the lack of reliable data sources became apparent.

The third paper was improved primarily by a number of consultations with E.P.S. Changes resulted in a number of sections. For example, more realistic solid waste disposal costs, a better knowledge of the economic life of industrial air pollution abatement equipment, and excellent data on automobile emission control equipment. The new total estimate is very similar to the previous one. However, we now feel that this paper, our third, has incorporated the best data sources available in Canada at this time. As new data becomes available we will consider additional revisions.

Introduction:

Most previous attempts at estimating the overall pollution abatement costs in Canada have been made by modifying American figures; usually by adjusting them either for population or for G.N.P. In this set of estimates we have attempted to use Canadian sources as much as possible or more precisely, estimates made for Canada in particular rather than adapting U.S. estimates. The estimates while being far from perfect are an attempt to aggregate Canadian sources and thus we consider them to be one step farther along the road towards accuracy.

The cost estimates presented in this paper, like all pollution cost estimates, are virtually useless unless the assumptions, the sources and the purpose behind the estimates are clearly defined. Therefore, before looking at the cost estimates themselves, an examination of the purpose and the assumptions of these estimates is in order.

The figures have been derived from a number of sources and the accuracy of these vary considerably. Some of the figures derived could at best be described as order of magnitude estimates. The actual sources used are documented during the detailed discussion of the estimates and a complete list of sources is found at the end of the paper.

The estimates were specifically made for use in the Pollution Control Cost Model being constructed by the Policy Branch. This model is designed to examine the economic effects of controlling pollution. The model assumes that pollution has been controlled to the required/desired standard by 1980; hence it seeks only to examine effects of pollution control through a study of pollution abatement costs. No attempt was made to find an optimum level of pollution control for the model, although from the pollution control cost estimates such standards as secondary treatment for sewage and the most

recent proposed No_x emission standards were assumed. Also, no estimate of the social and/or economic costs of not controlling pollution was made.

The earlier versions of the model were originally designed to show that the economic burden of pollution abatement costs was tolerable, even with continued economic and population growth; therefore, the estimates were made on the high side whenever any uncertainty arose. This was done because, if the model still showed that the costs continued to be within a tolerable range, then the point (that pollution control costs are a tolerable burden) would be made much more effectively if the estimates were all on the high side. If the estimates were on the low side, there would always be doubt about the general applicability of the model, and establishing median estimates was in most cases difficult and sometimes impossible. Where more than one source was available the highest estimate was chosen unless there was reason to believe that one of the sources was particularly reliable.

The scope of the model has been increased and the effects are now being analysed without attempting to prove a particular point. However, the basic idea of using the high estimates whenever there was any reasonable doubt has been retained. This is justified by the fact that most of the policy instruments that might be used can be considered much more reliable if they can work against high costs. If the policies are effective against high pollution abatement costs then it is assumed that they will also work against lower costs. The converse is not necessarily true. Thus no apology is made for the fact that no low or median values are presented here. If a significant demand for these other cost estimates arises, they might also be presented in future papers.

One of the key points in this paper is that the estimates are based on an estimation of the actual cost to society in a particular year and not on the actual expenditures of the society in that particular year. It is anticipated that to reach the desired level of pollution control for 1980 the expenditures will have to be significantly in excess of the costs since much "catch-up" is necessary. However, it is the long term economic burden that is being analysed in the model and to appreciate this, we must look at the costs per year on the same basis that a private company would assess its costs (versus its revenues) in any particular year. This is a feasible approach, because expenditures can be spread over the period of years to which they contribute benefits. All cost figures presented have ultimately been expressed in 1972 $, although the year they relate to is 1980.

It is recognized by the authors that the cost of pollution per se need also be estimated. The fact that this paper and the model which it supports only look at pollution control costs is in no way intended to suggest that the costs of not controlling pollution are unimportant. These two types of estimates are both needed. However, at this time, we do not have sufficient information to prepare estimates of pollution costs, even on an order of magnitude basis, comparable to the pollution control costs in this paper. We hope that this situation will soon change.

Besides supporting the Pollution Control Cost Model, the estimates for pollution control costs can also be of direct service. When the estimates for pollution costs per se are made (and this we hope will be done or at least attempted before 1980), they need only be pursued to the point where they equal or exceed the cost of pollution control for the sector concerned

to demand action on economic grounds. This is especially important when it is realized that pollution control costs tend to be tangible, whereas the costs of pollution are very often of an intangible nature. At present, pollution is being abated on the basis of intangible evidence involving such items as health and aesthetics pitted against definite economic costs of control.

The first step in turning the tide in this battle is to show that pollution control costs are not prohibitively high. The next step, and the clincher, will be to show that the pollution costs saved (the benefits of control) are as great or greater than the control costs, in comparable economic terms. Nothing in our society seems to bring about the committment of our scarce economic resources like clearly defined economic benefits.

Unfortunately, at this time, we are merely attempting to begin step one. But there always has to be a beginning and we hope that you will read the remainder of this paper.

Revised Pollution Control Costs

1980 (per annum) in 1972$

	$000,000's		
	CAPITAL	O & M	TOTAL
Municipal Sewage Treatment Plants	76.3[1]	91.5[2]	167.8
Sewers	152.5[3]		152.5
Municipal Solid Waste Disposal			616.4[4]
Air Pollution Control (Public)			
Stationary			124.4[5]
Mobile	325.0	620.5	945.5[5]
Government Facilities			25.0[6]
Public Sector Total:			2,031.6
Industrial Water Pollution Control	188.1	343.5	531.6[7]
Industrial Solid Waste Disposal			3,082.1[8]
Industrial Air Pollution Control	140.0	100.6	240.6[9]
Industrial Sector Total:			3,854.3
GRAND TOTAL:			5,885.9

Details of Cost Estimates

As mentioned earlier, the costs estimated for the Public Sector are based on the projected population for 1980. The figure used for these estimates was 25,001,000 and was obtained from the Ninth Annual Review of the Economic Council of Canada (1).

The pollution control cost estimates was adjusted, when they were not given in 1972 $, to 1972 $ by using the implicit GNE deflator (3). If no mention was made in the source document of the type of dollars used, it was assumed that the dollars were of the year in which the data collection was started.

Capital costs were for the most part spread over a twenty year period on a straight line depreciation basis. In other words, total capital costs were divided by 20 to yield the annual capital costs. We realize that some of the capital costs, i.e. land acquisitions, have an indefinite life and that the structures may have an economic life of 35 years or more. However, keeping in the spirit of the principle of estimating high when uncertain, we somewhat arbitrarily decided to use 20 years. The only exceptions were in the case of industrial air pollution control devices and emission control devices for cars. These will be explained later.

1/ MUNICIPAL SEWAGE TREATMENT COSTS (CAPITAL):

The Hedlin-Menzies Report (2) gave various per capita capital cost figures for secondary treatment plants, varying according to the size of the municipality. It also gave an average figure of $50.00 per person. We decided to use this latter figure, feeling that their data was not precise enough to warrant more detailed calculations. Divided by 20, this gave the annualized cost of $2.50. Multiplied by the 1980 population figure (1),

this yielded an estimate of $62,502,000 in 1967 $. Adjusted for 1972 $ (3), it became $76,252,440.

2/ MUNICIPAL SEWAGE TREATMENT COSTS (O & M):

The basic source for the operating and maintenance costs per year was also the Hedlin-Menzies Report (2). It estimated $3.00 per capita per year. Multiplied by population, this yielded an estimate of $75,003,000 in 1967 $. Adjusted to 1972 $ it became $91,503,660.

3/ SEWER COSTS (CAPITAL):

An average per capita cost of $100 was estimated for the construction of sewers by Hedlin-Menzies (2). (The cost of storm sewers is not included). Annualized, this means $5 per person. Multiplied by the population figure it yielded $125,005,000 in 1967 $ and adjusted for 1972 $ it became $152,506,100.

4/ MUNICIPAL SOLID WASTE DISPOSAL COSTS:

The following cost estimates were obtained from Solid Waste Management Division of E.P.S. (4).

Collection Costs	$18/ton
Incineration and/or Site Costs	$ 5/ton

These figures are considered to be reasonable average costs (on the high side) for collection and disposal of solid wastes for the country as a whole. Assuming that all solid wastes, both urban and rural, will be both collected and disposed of in 1980, the cost per ton should be about $23 (1972 $).

The Solid Waste Management Division (5) estimates that municipal wastes amount to 3.8 lbs./capita/day. This figure represents all solid wastes ultimately disposed of through municipal govenment facilities. It,

therefore, would include some wastes from commerical enterprises and light industries. Assuming that Gross National Solid Waste (GNS) per capita grows at the same rate as GNP per capita (GNP at 5.6%/year (1)), then the amount of solid waste produced should increase 54.6% from 1972 to 1980. This gives us a figure of 2,144 lbs. or 1.072 tons/capita/year. This means 26,801,072 tons of solid waste @ $23/ton for a total cost of $616,424,656 in the year 1980.

5/ AIR POLLUTION CONTROL COSTS (PUBLIC SECTOR):

Hedlin-Menzie's estimate for reducing the sulphur content of heating fuels is $75,000,000 for fuel oils and $27,000,000 for coal. This yields a total cost of $102,000,000 in 1967 $ and $124,440,000 in 1972 $.

From E.P.S. (6) we obtained the 1980 costs of pollution control devices on motor vehicles. The capital costs have been amortized over a five year period as this period corresponds to the life of the emission control devices. The O & M costs include the cost of increased gas consumption caused by the emission control devices, the maintenance required to maintain these devices and the increased costs for the preparation of non-leaded gasoline. It is assumed that the previously purposed reduction in the No_x standards for 1976 which would have required the expensive dual catalyst system will not come into effect.

The figures in 1972 $ for the year 1980 are as follows:

	Annualized Capital Cost	O & M Costs	Total
		($ millions)	
Automobiles	278.8	436.3	715.1
Light-duty Trucks	14.2	74.3	88.5
Heavy-duty Trucks and Buses	18.0	97.0	115.0
Diesel Trucks and Buses	14.0	12.9	26.9
	325.0	620.5	945.5

6/ GOVERNMENT FACILITIES:

From a discussion with the Federal Activities Protection Branch of E.P.S. (8) we learned that their budget estimation for 1980 is approximately $25 million with an operating budget of $6 million; although future uncertainties could raise this figure considerably higher.

7/ INDUSTRIAL WATER POLLUTION CONTROL COSTS:

From the Hedlin-Menzies Report (2) the following per annum figures in 1967 $ were derived.

INDUSTRY	ANNUALIZED CAPITAL COSTS	ANNUALIZED O & M COSTS
	($ millions)	
Pulp & paper	34.2	131.3
Petroleum refining	6.6	2.4
Iron & steel	18.0	33.8
Mining & concentrating	44.0	20.2
TOTAL:	102.8	187.7

Since these four industries yield about 2/3 of the industrial production, we added 50% to each of the above totals to allow for pollution control costs from the other industries. We, of course, realize that the industries listed above are major polluters and that the remaining industries are unlikely to contribute to water pollution proportionately to their total production of goods. However, in the light of our intention to estimate high in the face of uncertainty, we proceeded as if they did pollute to the same degree.

Therefore, in 1967 $, our figure for the annual capital cost in 1980 to control industrial water pollution is $154.2 million, and in 1972 $, $188.1 million.

For the operating and maintenance costs the figures are $281.6 million (1967 $) and $343.5 million (1972 $). The total annual costs then, is $531.6 million in 1972 $.

8/ INDUSTRIAL SOLID WASTE DISPOSAL COSTS:

For industrial solid wastes, we assumed that the cost per ton of disposal would be the same as for the solid wastes of municipalities. This was calculated earlier as $23/ton in 1972 $ (4). The Science Council of Canada (7) stated that industry produces five to ten times as much waste as Canadian municipalities. This lower estimate of "five times" was suggested by E.P.S., but it is at best a guestimate as no satisfactory study of this subject has as yet been done in Canada. Therefore, the industrial portion was estimated by multiplying the municipal figure by five to yield an estimate of $3,082,123,280 in 1972 $.

9/ INDUSTRIAL AIR POLLUTION CONTROL COSTS:

The Hedlin-Menzies Report (2), in estimating industrial air pollution control costs, simply took 50% of the capital costs of industrial water pollution control for Petroleum Refining, Iron and Steel, and 20% for Mining and Concentrating. From the O.E.C.D. estimates we obtained 25% for Pulp and Paper as a reliable ratio between water and air pollution control costs (9).

Discussion with E.P.S. (10) provided us with knowledge that the capital costs of air pollution abatement equipment are usually depreciated on average over a ten year period rather than a twenty year period.

The following table we derived from the Hedlin-Menzies Report (2) and the knowledge acquired from E.P.S.

INDUSTRY	ANNUALIZED CAPITAL COSTS	ANNUALIZED O & M COSTS
	($ millions)	
Pulp & paper (67$)	$34.20	$32.83
Petroleum Refining (67$)	6.70	1.20
Iron & Steel (67$)	18.00	16.90
Mining & Concentrating (67$)	17.60	4.04
	$76.50	$54.97

To these figures, we again added 50% to allow for the rest of the industries, as we did for industrial water pollution control. Accordingly, the figures for all the industries would be; capital costs: $114,750,000, and annual O & M costs: $82,460,000. These figures are in 1967 $. A conversion to 1972 $ revises the capital costs for industrial air pollution to $139,995,000 and the annual O & M costs for industrial air pollution to $100,601,200.

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The total estimate for the public sector is $2,031,600,000. For the industrial sector, the estimate is $3,854,300,000. The summation of these estimates, $5,885,900,000 is our estimate of pollution control costs for 1980, expressed in 1972 $.

Sources:

1. Economic Council of Canada, Ninth Annual Review, The Years to 1980, 1972.

2. Hedlin-Menzies and Associates Ltd., Initial Study of the Dimensions of Pollution in Canada, July, 1969.

3. Statistics Canada.

4. L.E. Willis, Environmental Protection Service, Ecological Protection Branch, Solid Waste Management Division, June, 1973.

5. E. Sanderson, Environmental Protection Service, Ecological Protection Branch, Solid Waste Management Division, November, 1973.

6. C. Nicholl, Environmental Protection Service, Air Pollution Control Directorate, Mobile Sources Division, November, 1973.

7. Science Council of Canada, Cities for Tomorrow, Some Applications of Science and Technology to Urban Development.

8. I. Strong, Environmental Protection Service, Federal Activities Protection Branch, Planning and Program Development Division, June, 1973.

9. Derived from data collected by E.P.S. for O.E.C.D. study, Pollution by the Pulp and Paper Industry, NR/ENV/73.13.

10. W.A. Lemmon, Environmental Protection Service, Air Pollution Control Directorate, Mining, Mineral and Metallurgical Division, June, 1973.